

PATENT



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
(Attorney Docket No. 11962ROUS02U)

In the Application of:  
Wen Tong et al.

§ Group Art Unit: 2662  
§ Examiner: Manh N. Nguyen

Serial No.: 09/766,267

Filed: January 19, 2001

For: FRAME STRUCTURE FOR  
VARIABLE RATE WIRELESS  
CHANNELS TRANSMITTING  
HIGH SPEED DATA

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**AFFIDAVIT OF PRIOR INVENTION UNDER 37 C.F.R. 1.131**

I hereby state, as a co-inventor of the present application, that I am currently employed by Nortel Networks Limited, the assignee of all right title and interest in the present application. Leo L. Strawczynski, also a co-inventor of the present application, is not longer employed by Nortel Networks Limited.

Together with my co-inventors, I helped conceive of and complete the invention of the present application earlier than December 13, 1999. I helped prepare a document entitled "ExRTT\_wen\_v0.1.ppt" memorializing the completion of the invention of the present application. A copy of this document is attached as Exhibit A. This document was last modified December 13, 1999 as evidenced by the screen shot attached as Exhibit B. However, Exhibit A was created prior to December 13, 1999.

Further evidencing the completion of the current invention is a document that was disclosed internally on January 7, 2000 to the patent group of Nortel. This disclosure document

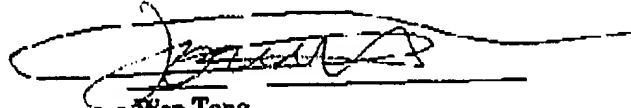
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BEST AVAILABLE COPY

is attached hereto as Exhibit C.

I hereby state that all statements made herein are of my own knowledge, that they are true, and that all statements made herein are made on information and belief and are believed to be true. I acknowledge that any willful false statements made herein would be punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon.

Date: November 24, 2005



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**AFFIDAVIT OF PRIOR INVENTION UNDER 37 C.F.R. 1.131 BY ASSIGNEE OF**  
**INTEREST**  
**(ON BEHALF OF DEPARTED INVENTOR LEO L. STRAWCZYNSKI)**

My name is Curt Dodd. My home address is stated below by my signature. I am a patent agent and lawyer employed by Nortel Networks Limited. The facts stated herein are of my personal knowledge.

Wen Tong, Shalini S. Periyalwar, Leo L. Strawczynski, and Claude Royer are co-inventors of the above-referenced application. I am responsible for the continued prosecution of this application. This Affidavit is submitted by Nortel Networks Limited, the assignee of all right title and interest in this application and in lieu of submission of an affidavit by Leo L. Strawczynski, who is no longer is employed by Nortel Networks Limited and is unavailable to execute an affidavit. Attached hereto as Exhibit D is a Power of Attorney evidencing that I have the authority to execute this Affidavit on behalf of Nortel Networks Limited, the assignee of all right, title, and interest in this Application.

The invention of the present application was completed prior to January 7 of 2000. The invention was first disclosed internally on January 7, 2000. Attached hereto as Exhibit C is a copy of a disclosure document that was submitted internally on January 7, 2000, evidencing completion of this invention no later than January 7, 2000.

I hereby state that all statements made herein are of my own knowledge, that they are true, and that all statements made herein are made on information and belief and are believed to be true. I acknowledge that any willful false statements made herein would be punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon.

Date: November 25, 2005

  
**Curt Dodd**

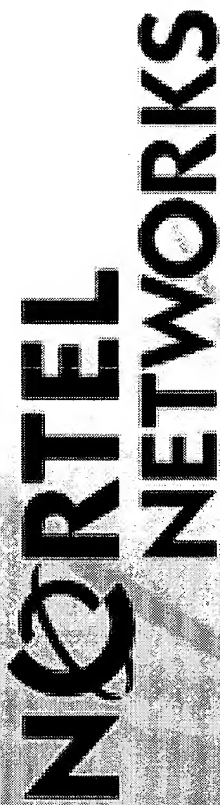
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# E-1xRTT: The Evolution of IS-2000 for High Speed Data

LS - Leo Strawczynski

GW- Geng Wu

DB - Damian Bevan

JH - John Hudson

AS - Adrian Smith

SP - Shalini Periwalayar

CH - Chengong Huang

WT - Wen Tong

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Exhibit A

# Physical Layer - Key System Aspects /Advantages of Physical Layer Design (WT)

Key Physical Layer Attributes	
Chip Rate	1.2288Mcps
FL Data Rates (Kbps)	76.8, 102.6, 153.6, 204.8, 307.2, 614.4, 921.6, 1228.8, 1843.2, 2457.6, 4915.2
RL Data Rates (Kbps)	9.6, 19.2, 38.4, 76.8, 153.6, 307.2
Modulation	FL: QPSK, 8PSK, 16/32QAM RL: BPSK
Coding	Turbo Coding ( $g=15/13$ , $R=1/2$ )
RL Frame (ms)	2.5, 5, 20, 40, 80
FL Slot (ms)	1.25
Power Control	RL: Closed Loop (800Hz) FL: Non
Pilot	RL: CDM, FL: TDM
Multi-Code Covering	Mode-1: 16x16 Walsh Mode-2: Quasi-Orthogonal
Tx Diversity	Closed Loop: TxAA, Open Loop: STTD

- **RL Maximum Reuse 1XRTT**
  - with minimum modifications
- **FL Fat TDM Pipe**
  - slot based fast rate adaptation
  - user C/I driven
  - explicit rate information header
- **Highly Asymmetric Traffic Configuration**

# Physical Layer - Key System Aspects /Advantages of Physical Layer Design (WT)

- Higher Peak Data Rates and Spectral Efficiency
  - 2.4Mbps, 16-QAM,
- Advanced Adaptive Antenna Processing
  - Hybrid TxAA/STTD at BTS, MRC at Terminal
- Fast Adaptive Coding and Modulation
  - Per User Rate and Modulation Adaptation Based on C/I
- Allow Multi-User Detection (MUD) at Terminal
  - Use Very Efficient MUD to Eliminate Error Floor of Rake Receiver

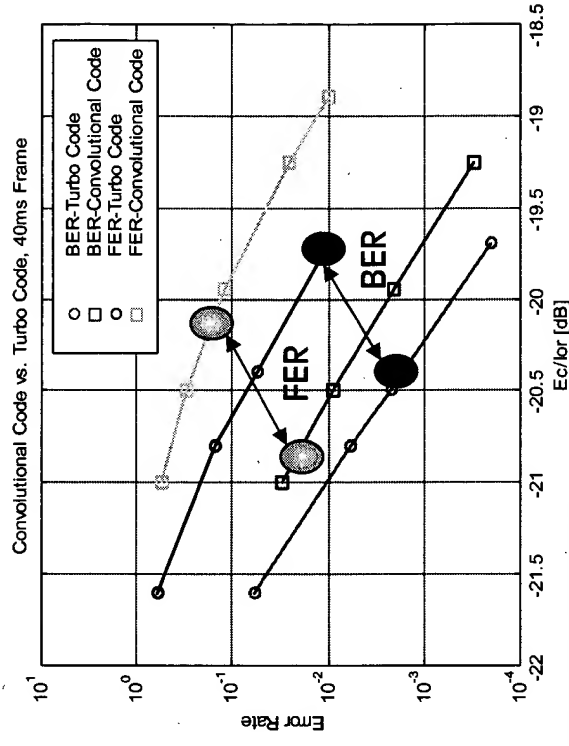
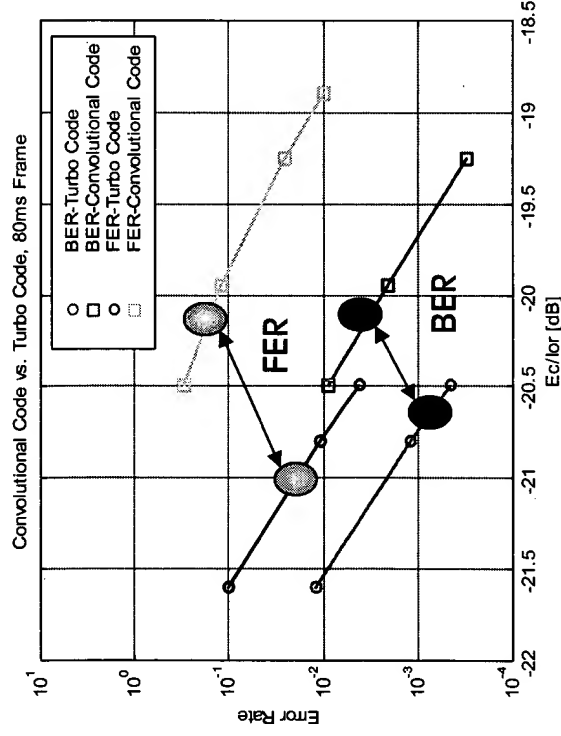
# Physical Layer - Key System Aspects /Advantages of Physical Layer Design (WT)

- Soft Handoff at RL, Firm Handoff at FL
  - Macro-Diversity MRC Combining SHO for RL
  - Buffered Packets with no Loss HO for FL
- Adaptive Access Point Selection
  - Terminal MRC Interference Rejection
- Same RF Front-End as for 1XRTT
  - For both BTS and Terminal



# Reverse Link- Improvements/Modifications to 1xRTT (WT)

- Multi-Frame RL Fundamental Channel Structure
  - 40ms, 80ms frame for Radio Configuration 3 and 5
  - R=1/4 Turbo coding, 0.7-1.3dB gain, additional 70% Capacity gain
  - Simulation Conditions:
    - Veh.-A Channel, 120kmph, Data Rate 9.6kbps, 4% Power Control Error Rate

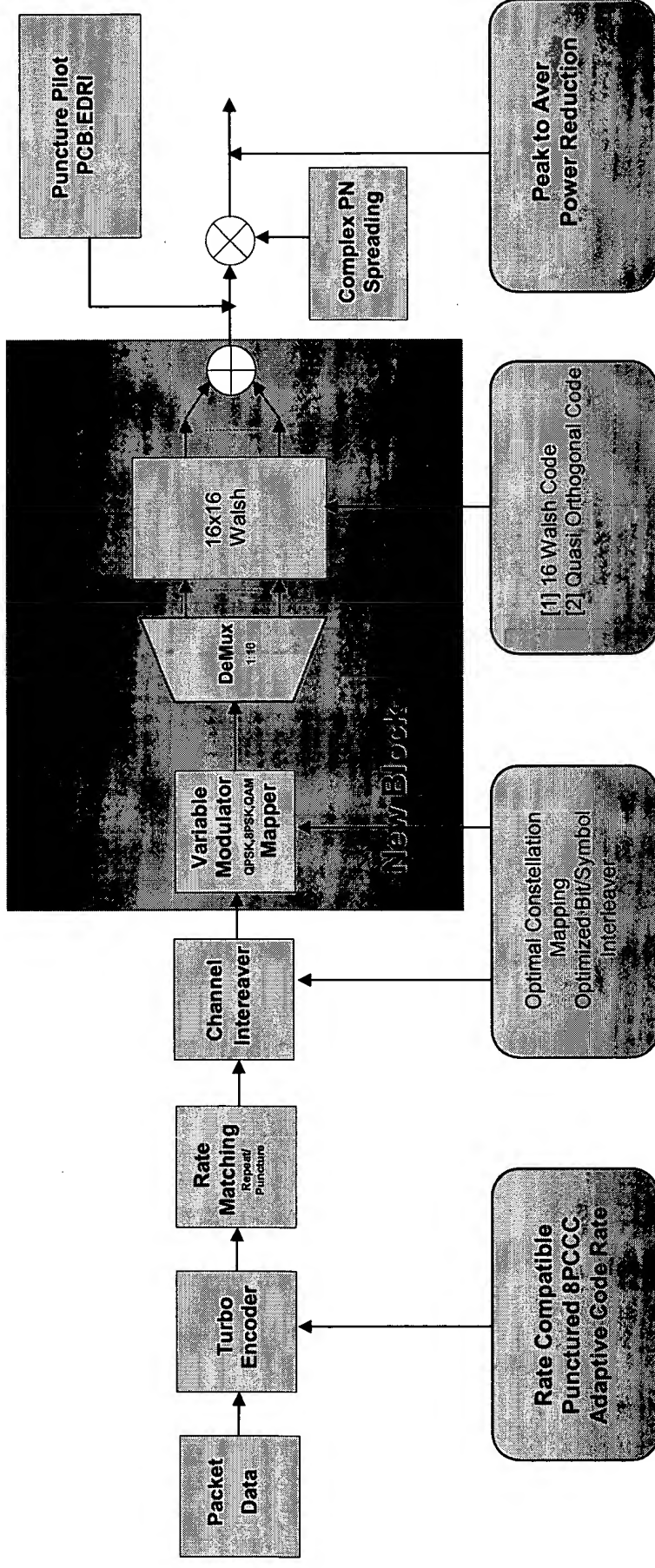


# Reverse Link- Improvements/Modifications to 1xRTT (WT)

- New 2.5ms Frame Dedicated Control Channel for Fast In-Band Signaling
  - Use RDCCH for average C/I report
  - To indicate preferred BTS for next frame transmission
  - To support alternate selection of TxAA and STTD on the FL
- Reverse Power Control Sub-Channels
  - The power control sub-channel punctured on the reverse pilot channel is not can be used for fast signaling, i.e. delta value of C/I
- Enhanced Soft Handoff via Marco Diversity MRC at BSC

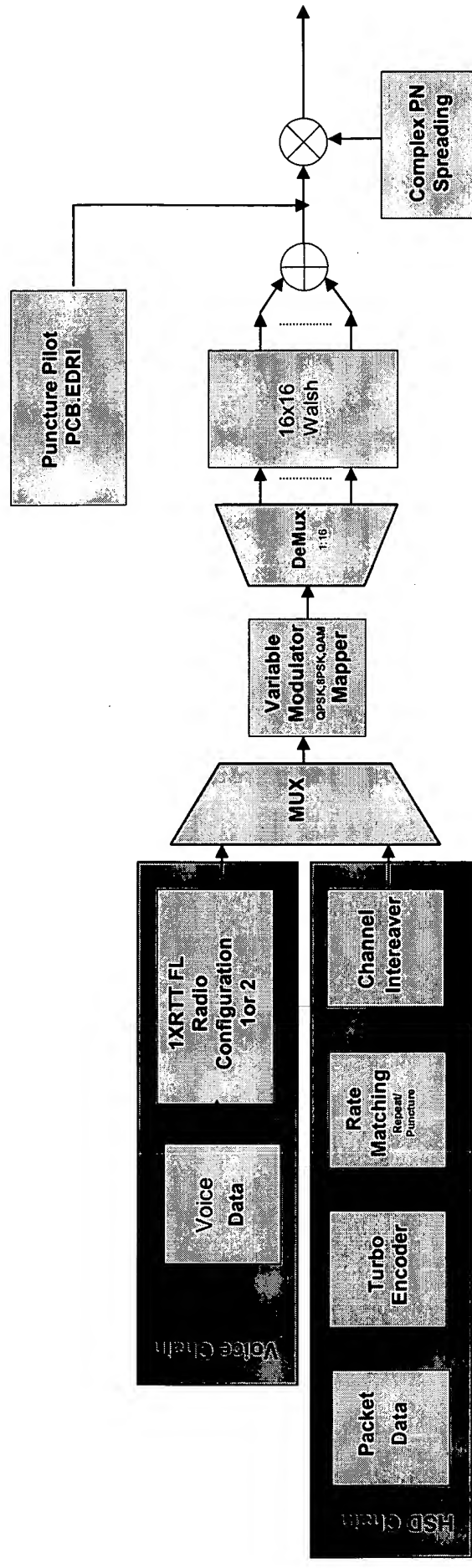
# Forward Link (HSD Only Mode) (WT)

- Introduce Higher Order Modulations
  - To increase peak rates and throughput
- TDM Signaling Allows Higher Data Throughput



# Forward Link (Simultaneous Voice and HSD)

- Introduce Sub-Frame Unit for Voice Insertion
  - Data Stealing from HSD Field
- Designed for 8 Simultaneous Voice and HSD Users
  - Supplementary to the HSD Users



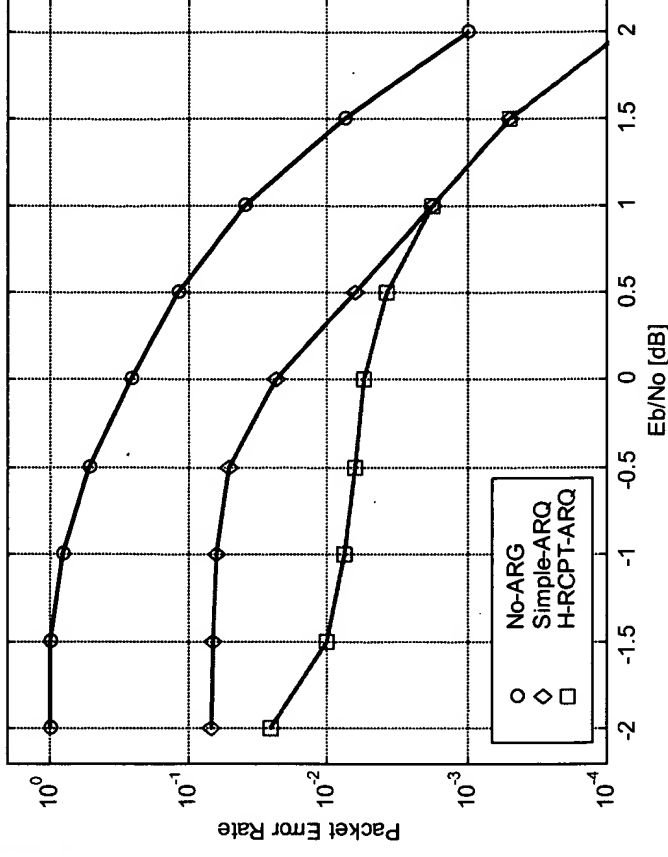
# Adaptive Modulation and Coding (WT)

- **Short Term Block Fading Based Modulation Adaptation**
  - Date Rate Selection Per Slot Per User
- **Incremental Redundancy ARQ**
  - Rate Compatible Punctured Turbo Code (RCPTC)
- **Achieve Better Throughput by Partial Re-transmission**
- **Accommodate Different Error Protection**
  - Finer Granularity Rate Adjustment using Adaptive Hybrid ARQ
- **Rate Compatible Puncturing:**
  - Adjustable Coding Rates:  $R=1, 2/3, 1/2, 2/5, 1/3$
  - Reduce the Sensitivity of Channel Estimation Error

# Adaptive Modulation and Coding (WT)

- Advantages of RCPTC-Hybrid ARQ
  - Enhance throughput for low C/I users
  - Avoid fragmentation and re-assembly

Simulation Conditions	
Packet Size	2.5ms, 320 bits
FL Data Rate	153.6Kbps
Modulation	QPSK
Channel	2 GHz, AWGN
Coding	Turbo Coding ( $g=15/13$ , $R=1/3$ )
RAKE Combining	Max. Ratio Combining, 4 fingers
Hybrid ARQ	Max. Retransmission = 3, Packet Combining,



# Peak Data Rates (WT)

- FL & RL Peak Data Rates Follow 1XRTT Numerology
- Consider Simultaneously Voice and Data Service

**HSD Forward Link Peak Rates**

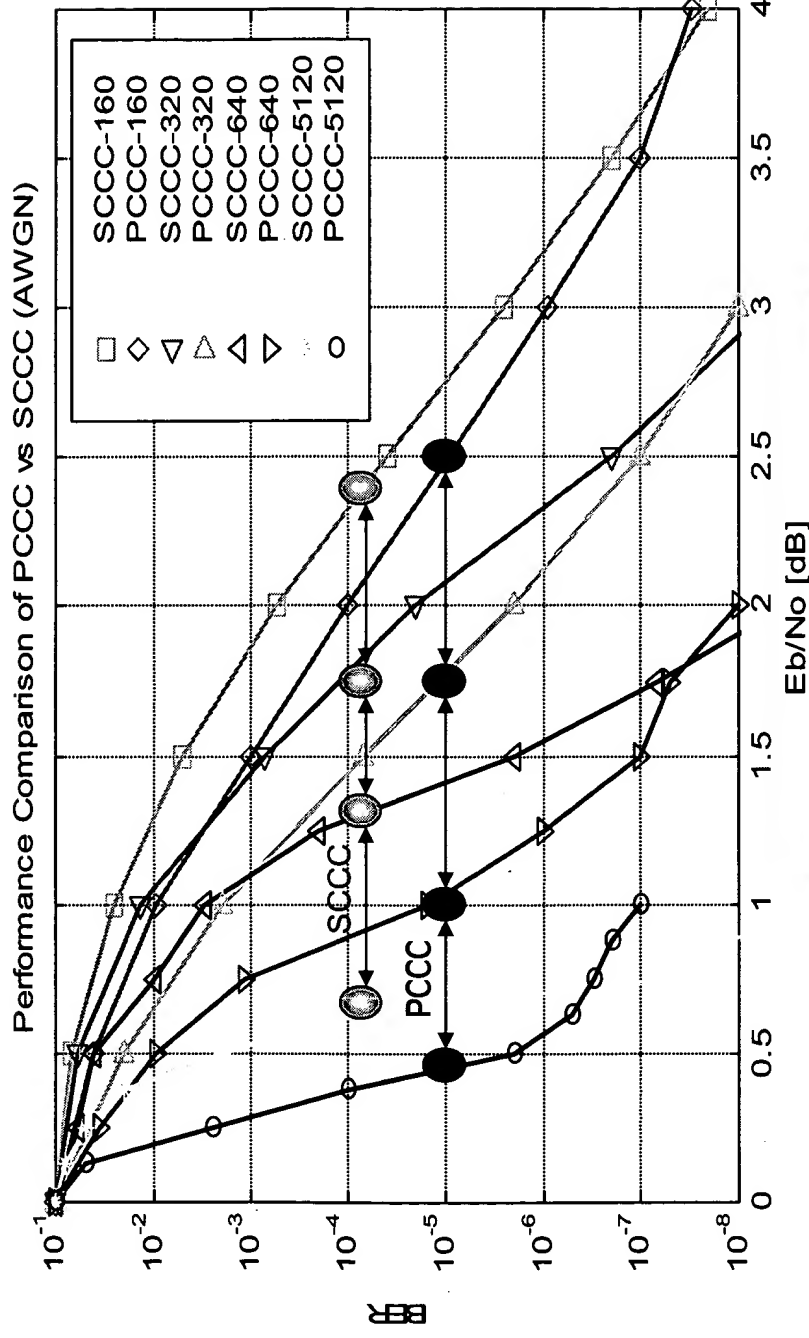
	Data rates (kbps)									
Parameter	76.8	153.6	307.2	614.4	921.6	1228.8	1843.2	2457.6	4915.2	
Bits Per Packet	1536	1536	1536	1536	3072	2048	3072	4096	8912	
Modulation Type	QPSK						8 PSK	16 QAM	32 QAM	

**HSD Reverse Link Peak Rates**

	Traffic						Access
Data Rate(kbps)	9.6	19.2	38.4	76.8	153.6	307.2	9.6
Bits per Packet	512	1024	2048	4096	8192	8192	512
Modulation Type	BPSK						

# 8-State PCCC Turbo Code(WT)

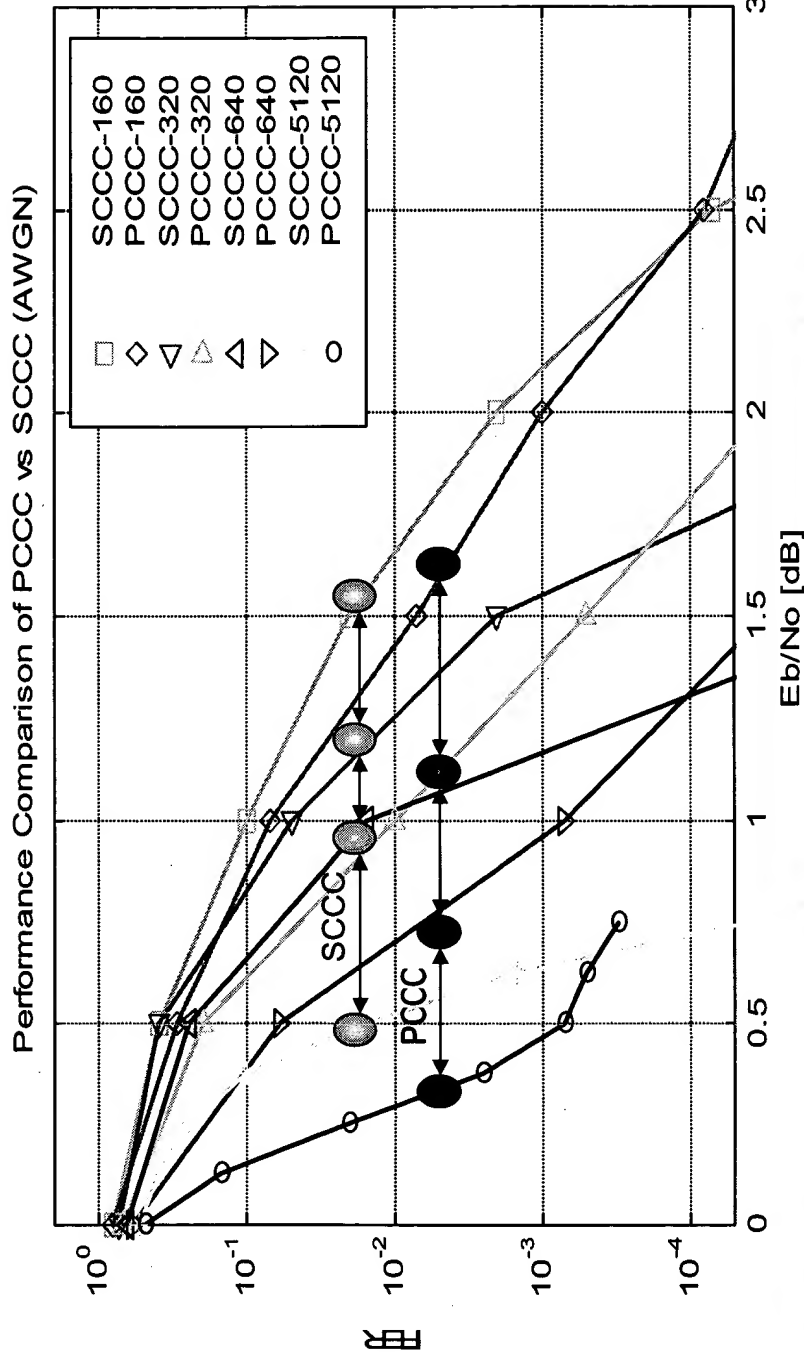
- 1XRTT 8-State Parallel Concatenated Convolutional Code(PCCC) has Better Performance than 4-State Serial Concatenated Convolutional Code (SCCC)





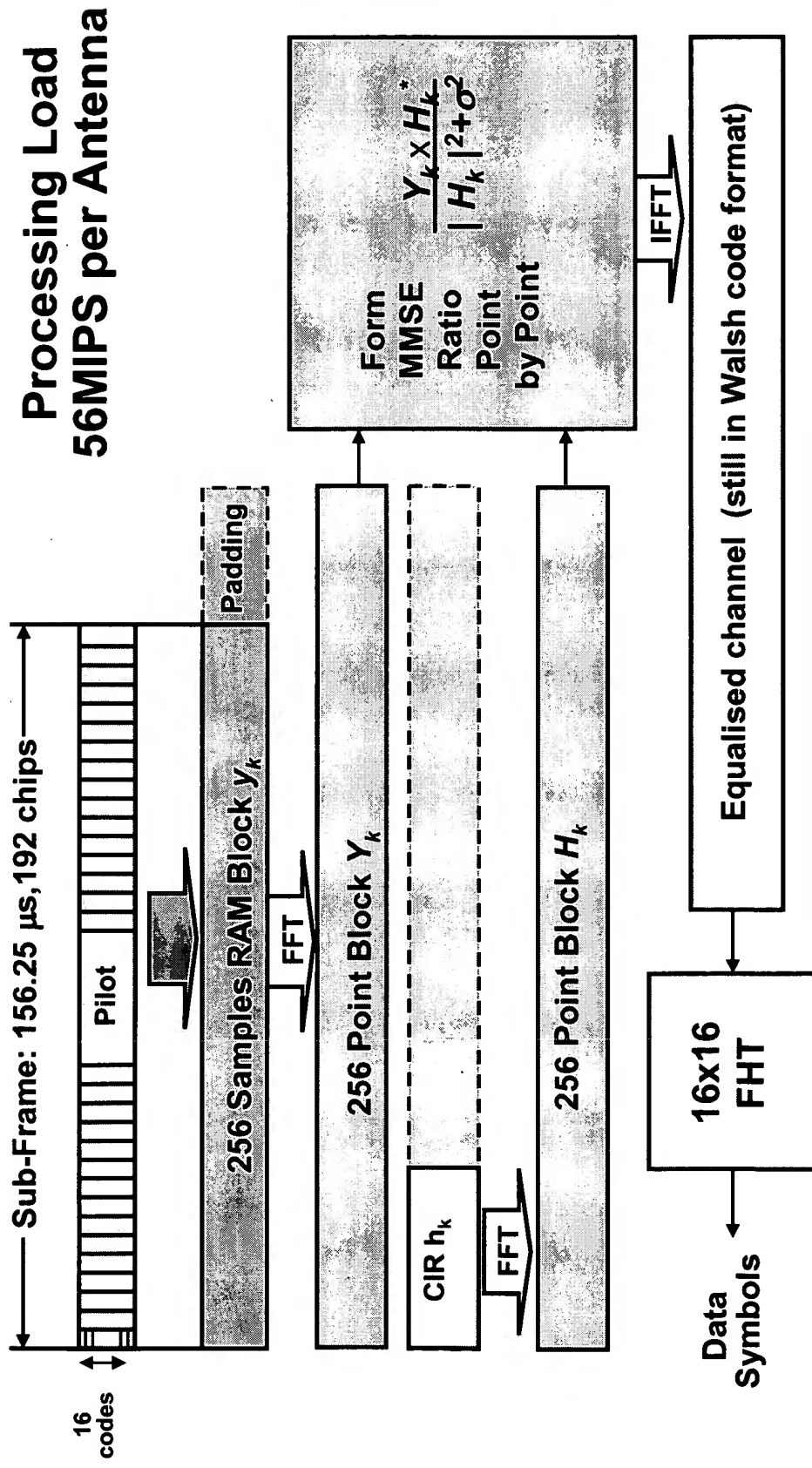
# 8-State PCCC Turbo Code(WT)

- The Turbo Decoders for 8-State PCC and 4-State have same Complexity
  - PCCC has more gain over SCCC as packet size increases



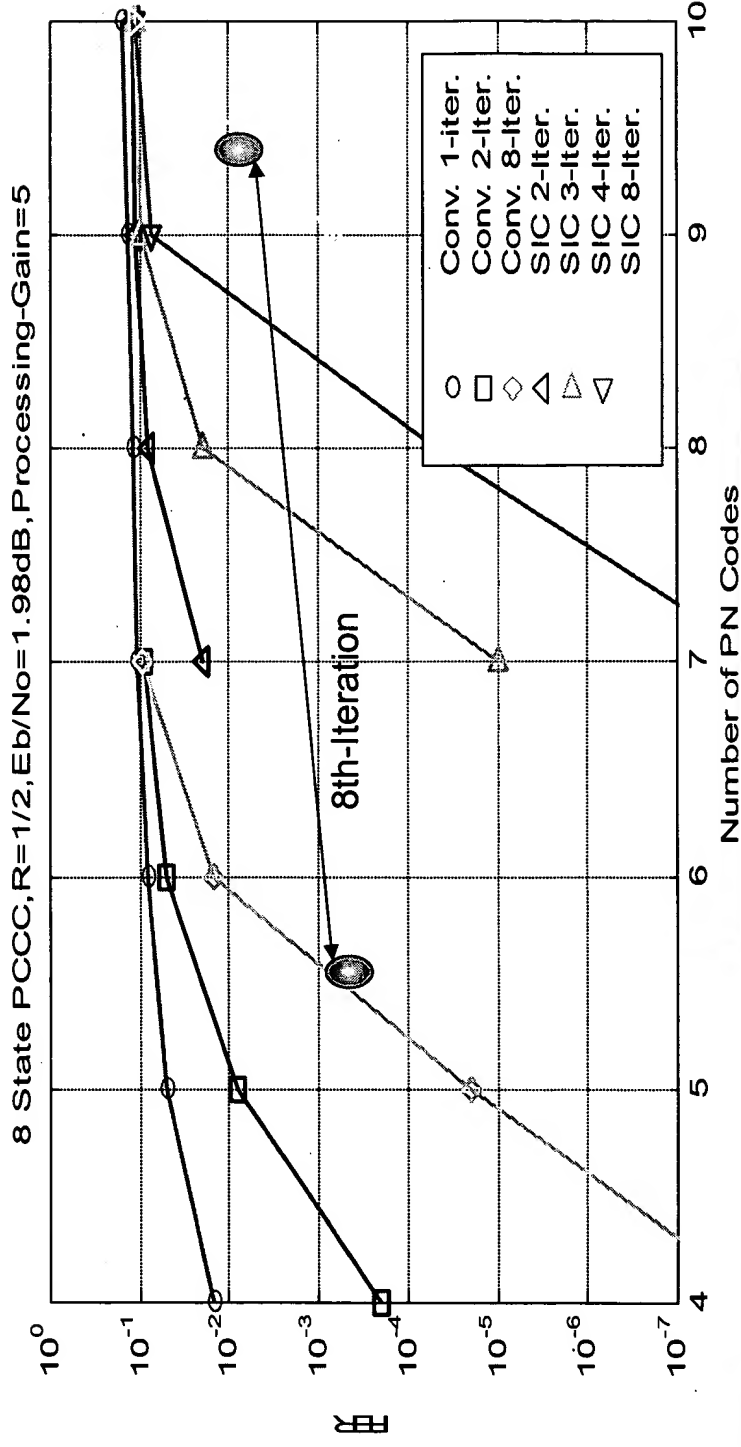
# MUD Technique for Terminal

- High Efficient MUD for 16x16 Walsh Covering



# MUD Technique for Terminal

- Using Quasi-Orthogonal Multi-Code Gain Spectral Efficiency
- Inter-Code Self Interference Cancellation at Terminal
  - Iterative Interference Cancellation Technique
  - 2-Stage MUD Gain 80% Spectral Efficiency



# Terminal Receiver Structures (JH)



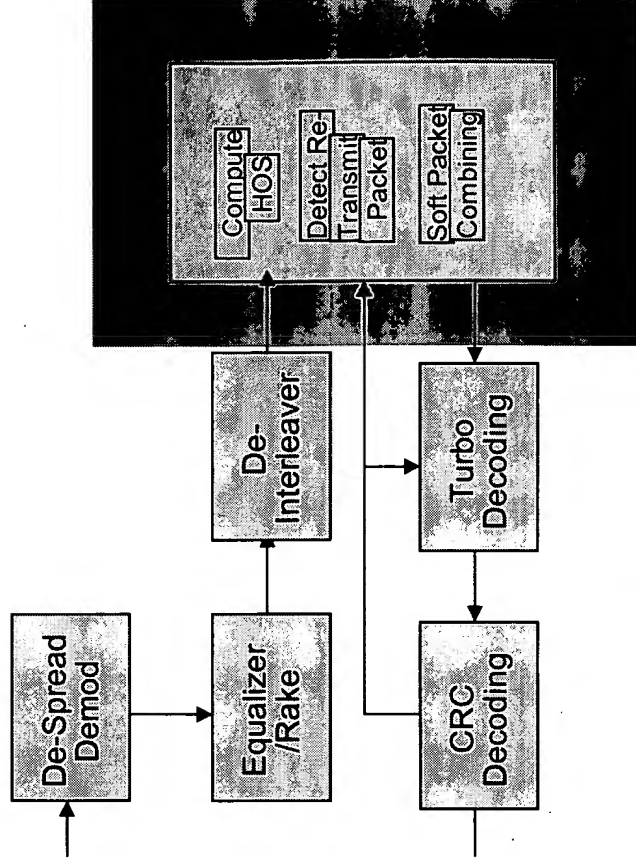
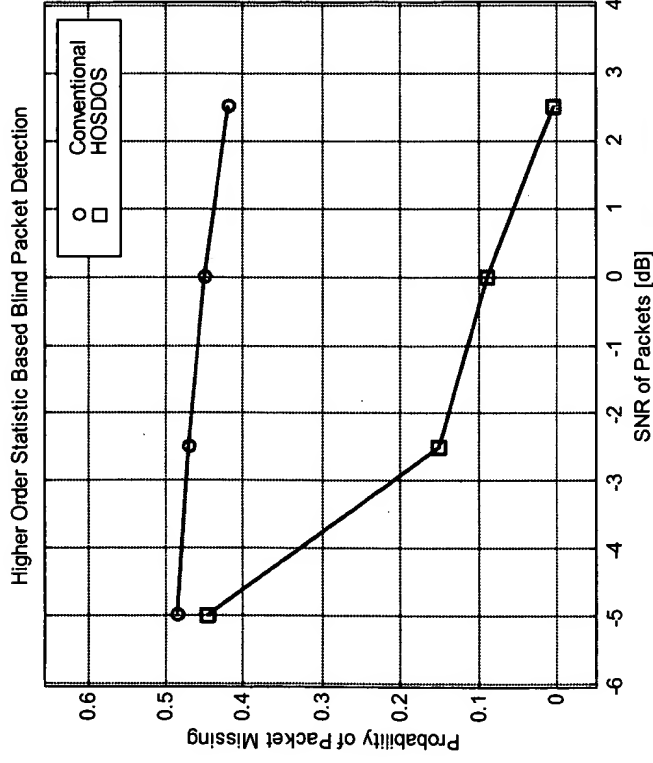
Draft v0.0-- not for distribution  
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# ARQ with Soft-Combining & HOS (WT)

- **Blind Recursive Packet Combining**
  - Higher-Order-Statistic (HOS) Based Packet Detection
- **Allow Free Scheduling of Re-transmission of FL Packets**
  - No need for indication of re-transmission packet location
  - Reduce the FL protocol overhead
- **Lower Required SNR for Packet Transmission**
  - minimize power for the transmission of packets
  - minimize re-transmissions (to increase throughput, reduce delays)
- **Range Extension of Higher Data Rate Service**
  - Cell boarder high rate enhancement
    - Better to keep higher rate for re-transmission

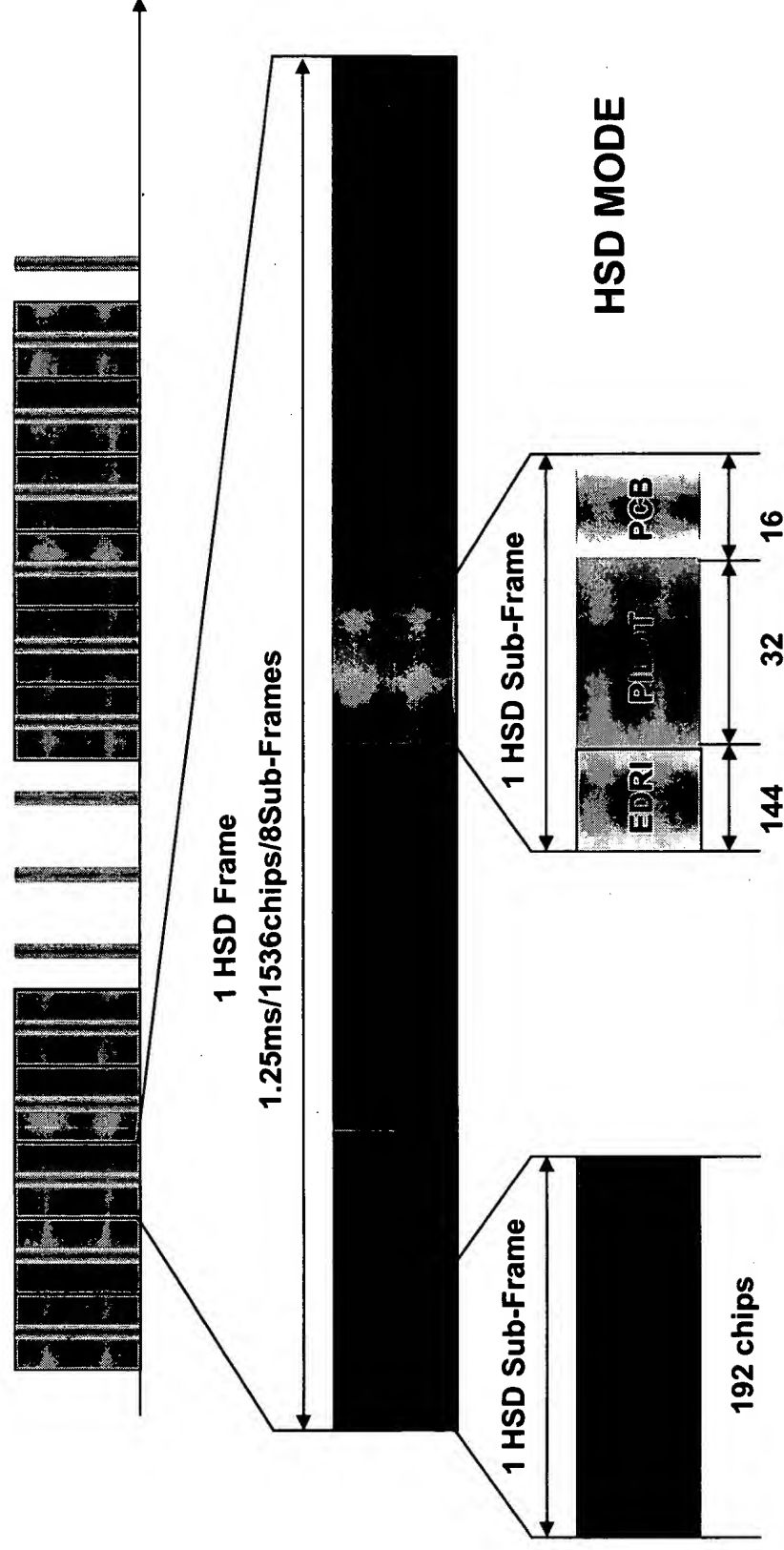
# ARQ with Soft-Combining & HOS (WT)

- Coded Symbol Level Packet Detection and Combining
  - Requirements minimum computing and memory for soft combining
  - Simulation Conditions: Packet size:192 bits,AWGN,MAX\_re-trans:3, random re-trans position.



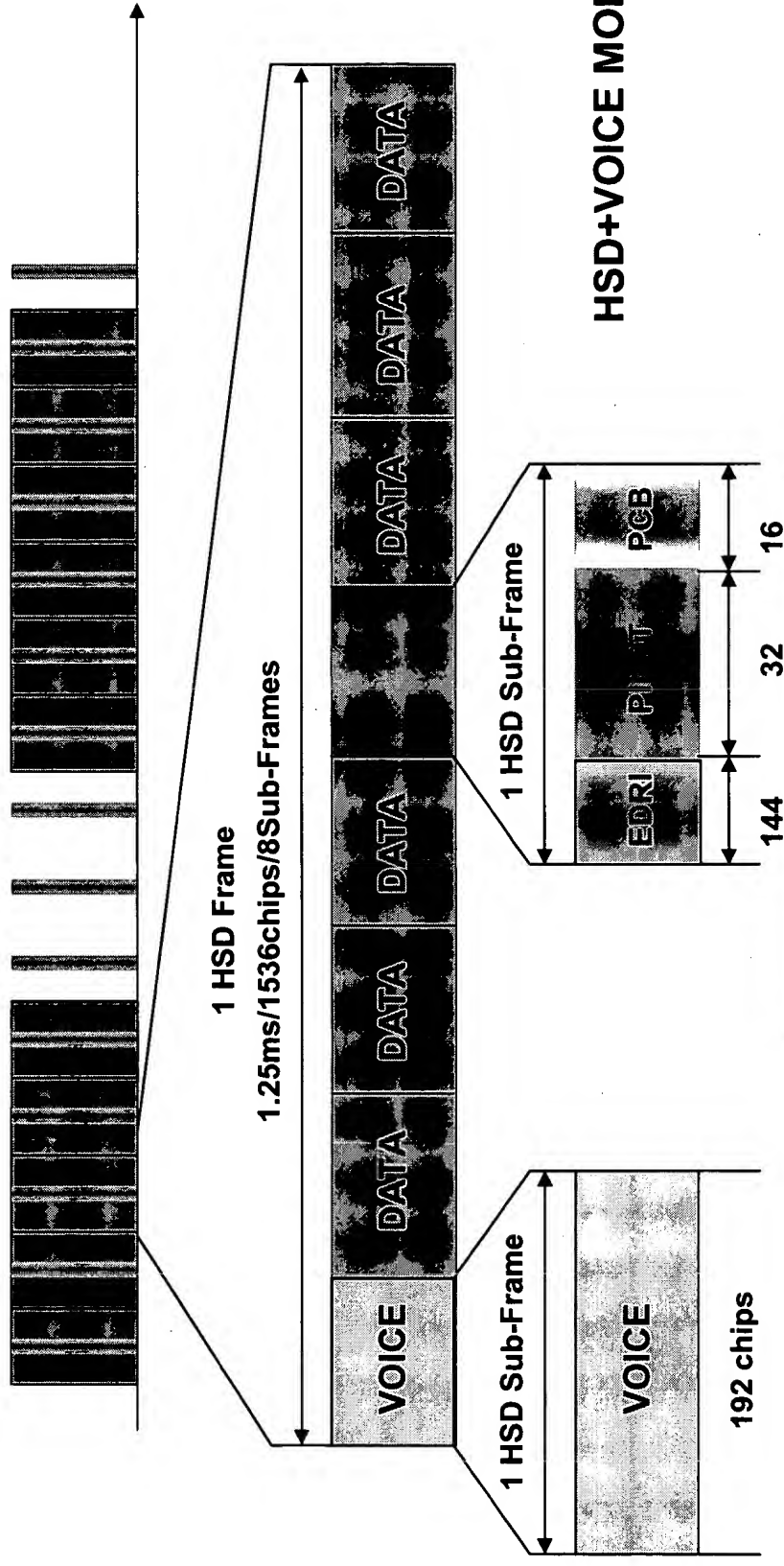
# Channel Structure and Control (WT)

- Data Field Blank-&-Burst Transmission
- Pilot/PCB Filled Broadcast Constantly



# Channel Structure and Control (WT)

- Provide Voice Service By Using Sub-Frame Stealing
- Maximum 8 HSD+Voice Calls Allowed





# Channel Structure and Control (WT)

- 1.25ms Slot Duration aligns RL Power Control Group
- Two Modes User Packet Packing
  - Homogenous Mode: 1-slot only carries one user packets
  - Heterogeneous Mode: 1-slot carries more than one user packets
- Power Control Bit (PCB) Field can Serve 32 users
  - PCB is punctured on I & Q branches separately
- Introduce Explicit Data Rate for Fast Rate Adaptation
  - (12,24) Golay coding is used for Explicit Data Rate Indicator (EDRI), robust to channel error.
  - 4-bit for FL data rates; 5-bit for user Id; 3-bit for heterogeneous mode indication

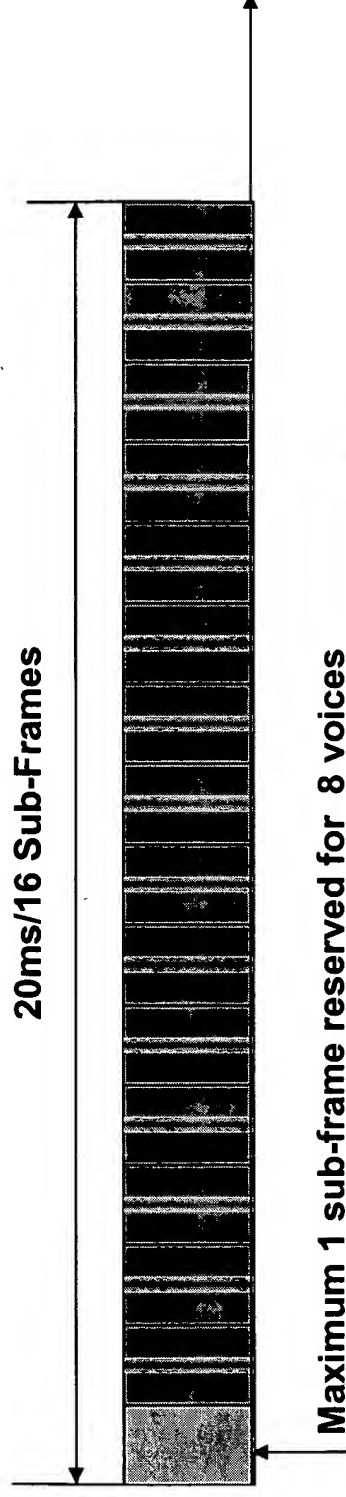
# Channel Structure and Control (WT)

- FL Framing and Control

- Terminal shall decode the EDRI field and to identify the user Id.  
For each HSD frame
  - If the slot Id matches then use the EDRI information to proceed the pilot and data processing
  - The framing is based on the data rate, dynamically allocated to achieve highest throughput per sector
  - One user packet can consist multiple HSD frames
  - In the multicast distribution case, one HSD frame can consist of multi-user packets.
- In order to support simultaneous voice and data, voice and data can be multiplexed into one HSD frame

# Channel Structure and Control (WT)

- **Multiplexing Voice and Data**
  - Provide a support for simultaneous voice and HSD services
    - Maximum 8 voice calls are designed
    - Blind rate detection for voice
- **One Sub-Frame can be Potentially Occupied by Voice**
  - Complete loss for 76.8kpbs rate, 1/16 throughput loss for 1.2288Mbps rate
- **Dynamic Allocate Voice with Flexibility**
  - Gracefully tradeoff peak throughput with voice+HSD service

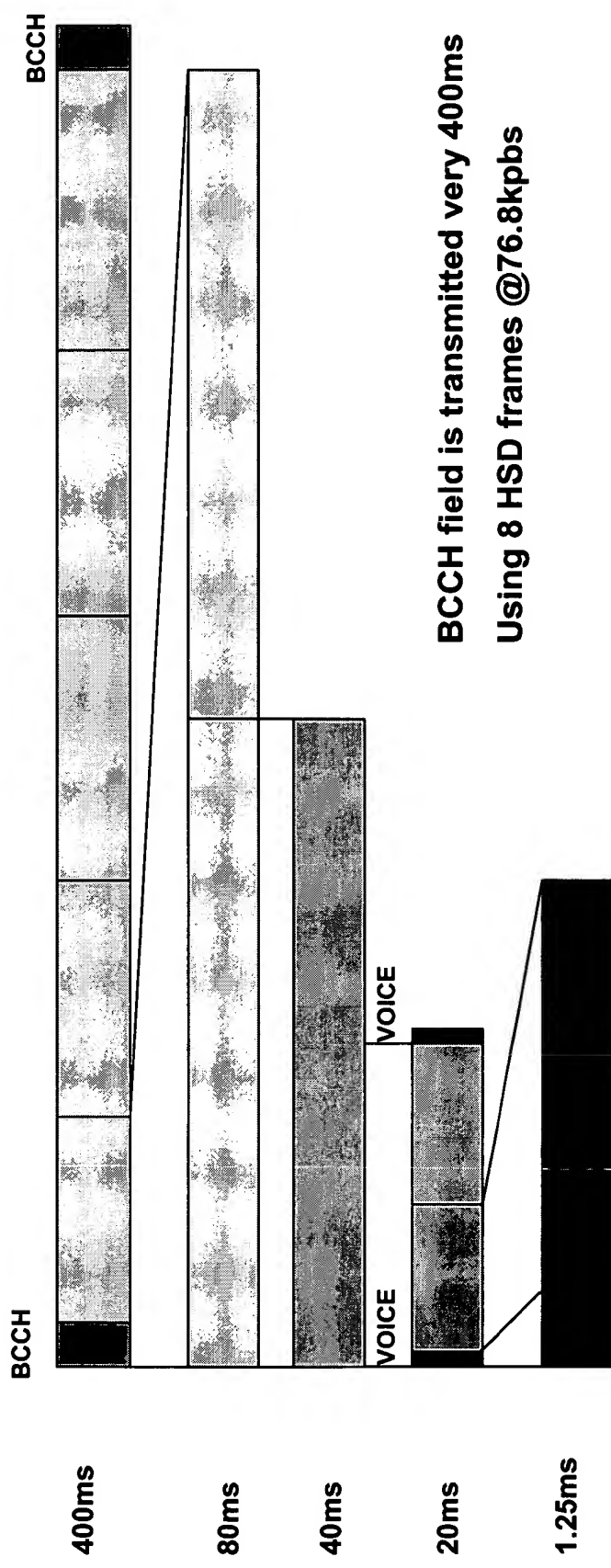


# Physical Channels (WT)

- FL Physical Channel Consists of 4 Fields in the Slot
  - Pilot
  - Data
  - EDRI
  - PCB
  - BCCH
- Design Principles
  - Combine all the FL dedicated traffic channels into data field
  - Allocate the common channel into BCCH field
  - Create separate power control channel (PCB field)
  - Create a set of pilot symbols to allocate:
    - Forward, Tx Diversity, Auxiliary Pilot Channels
  - Pack Sync, Paging into BCCH field

# Frame Structures: 20/40 ms Super-frame, 2.5 ms Frame (WT)

- 20ms, 40ms and 80ms Super-Frame are used for FL/RL Common Channel Timing
- 2.5ms Frame is used for the RL Fast In-Band Signaling



Name	Size	Type	Modified
ATI		File Folder	9/17/2003 11:47 AM
Dec25		File Folder	2/15/2004 8:12 PM
GengW		File Folder	9/17/2003 11:47 AM
HDR		File Folder	2/12/2005 8:31 AM
JohnHudson		File Folder	9/17/2003 11:47 AM
Moto		File Folder	9/17/2003 11:47 AM
ProvPAT		File Folder	2/15/2004 8:26 PM
1x_evolution_instructions_2...	42 KB	Microsoft Word Doc...	1/27/1999 11:40 AM
C30-20000111-004_LGIC_no...	370 KB	Microsoft PowerPoint...	2/9/1999 11:54 AM
cdgevolutionRpt-5.doc	1,041 KB	Microsoft Word Doc...	12/16/1998 7:43 AM
db65.xls	30 KB	Microsoft Excel War...	12/6/1999 6:07 PM
Db90.xls	29 KB	Microsoft Excel War...	12/6/1999 6:06 PM
distribution.m	1 KB	M File	12/15/1999 9:49 AM
distribution_1.m	1 KB	M File	12/15/1999 9:42 PM
e1x_Recommendation.ppt	209 KB	Microsoft PowerPoint...	3/8/1999 4:47 PM
E-1xRTT_v0.1.ppt	1,151 KB	Microsoft PowerPoint...	12/13/1999 2:07 PM
E-1xRTT_wen_v0.1.ppt	388 KB	Microsoft PowerPoint...	12/13/1999 9:37 PM
E-1xRTT_wen_v0.2.ppt	272 KB	Microsoft PowerPoint...	12/14/1999 4:30 PM
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HARQ.ppt	1,354 KB	Microsoft PowerPoint...	6/5/1999 9:14 PM
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HSD Forward Link Peak Rate...	12 KB	Microsoft Word Doc...	12/14/1999 4:40 PM
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prob.emf	19 KB	EMF File	12/15/1999 9:49 AM
rnrh_1.emf	21 KB	EMF File	12/15/1999 10:43 AM

## Invention Disclosure Submission Reply

<b>Disc No:</b>	11962RO	<b>Received Date:</b>	07 jan 2000
<b>Disclosure Title:</b>	High Speed Data Slot Structure		

### ---== Inventors ==---

Global Id	Name	Work Info	Home Info
050355 6	<b>HR Name:</b> TONG, WEN <b>Known As:</b> WEN <b>Email:</b> wentong@no rtel.com <b>Mgr First Name:</b> JOHN <b>Mgr Last Name:</b> HOADLEY <b>Mgr Global ID:</b> 0144683	<b>Location:</b> 3500 CARLING AVENUE OTTAWA ONTARIO K2H 8E9 CANADA <b>Location Code:</b> CAR <b>Dept:</b> DP20 <b>Phone:</b> 3931315 <b>Ext Phone:</b> 7631315 <b>Fax:</b> <b>Ext Fax:</b> <b>MailStop:</b> 04393W26 <b>Citizenship:</b> CANADA	<b>Address:</b> 12 WHITESTONE DRIVE OTTAWA, ON CANADA K2C 4A7 <b>Phone:</b> (0)6137980466
050072 4	<b>HR Name:</b> PERIYALWAR, SHALINI <b>Known As:</b> SHALINI <b>Email:</b> shalinip@nor tel.com <b>Mgr First Name:</b> BILL <b>Mgr Last Name:</b> GAGE <b>Mgr Global ID:</b> 2856986	<b>Location:</b> 3500 CARLING AVENUE OTTAWA ONTARIO K2H 8E9 CANADA <b>Location Code:</b> CAR <b>Dept:</b> AN00 <b>Phone:</b> 3955888 <b>Ext Phone:</b> 613-765-5888 <b>Fax:</b> <b>Ext Fax:</b> <b>MailStop:</b> 04391Y30 <b>Citizenship:</b> CANADA	<b>Address:</b> 88 SUMMERWALK PLACE NEPEAN, ON CANADA K2G 5Y4 <b>Phone:</b> (0)6132742887
150232 4	<b>HR Name:</b> STRAWCZ YNSKI, LEO <b>Known As:</b> LEO <b>Email:</b> <b>Mgr First Name:</b> MAURICE <b>Mgr Last Name:</b> O'SULLIVAN <b>Mgr Global ID:</b> 1402322	<b>Location:</b> 3500 CARLING AVENUE OTTAWA ONTARIO K2H 8E9 CANADA <b>Location Code:</b> CAR <b>Dept:</b> QN10 <b>Phone:</b> <b>Ext Phone:</b> 613-763-7836 <b>Fax:</b> <b>Ext Fax:</b> <b>MailStop:</b> <b>Citizenship:</b> CANADA	<b>Address:</b> 479 HIGHLAND AVENUE OTTAWA, ON CANADA K2A 2J5 <b>Phone:</b> (0)6137299968

## Nortel Networks Confidential & Privileged Information

161450 9	<b>HR Name:</b> ROYER, CLAUDE <b>Known As:</b> CLAUDE <b>Email:</b> croyer2@nortel.com <b>Mgr First Name:</b> ALAUDDIN <b>Mgr Last Name:</b> JAVED <b>Mgr Global ID:</b> 1524826	<b>Location:</b> 3500 CARLING AVENUE OTTAWA ONTARIO K2H 8E9 CANADA <b>Location Code:</b> CAR <b>Dept:</b> DP00 <b>Phone:</b> 3954354 <b>Ext Phone:</b> (613)-765-4354 <b>Fax:</b> <b>Ext Fax:</b> <b>MailStop:</b> 04391W29 <b>Citizenship:</b> CANADA	<b>Address:</b> 170 CHAMPLAIN GATINEAU, QC CANADA J8X 3R2 <b>Phone:</b> (0)8197766030
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### ==== Attachments =====

<End of Attachments>

<b>Were there additional inventors involved:</b> yes		<b>Was there contractor involvement:</b> no	
<b>Name of Supervisor or Divisional Head:</b>		<b>Name of VP:</b>	
CLAUDE ROYER		AL JAVED	
<b>LOB:</b>	Wireless Solutions	<b>Business Unit:</b>	ATCW
<b>Conception Date:</b>			
<b>Has this invention been discussed with others? If so, please complete:</b>			
<b>Inside Nortel - Whom?</b>		<b>Outside Nortel - Whom?</b>	
<b>Inside Nortel - When?</b>		<b>Outside Nortel - When?</b>	
<b>NDA?</b> yes			
<b>Are you aware of any imminent future disclosures? Please provide dates and details:</b>			
Yes, Jan 21, 2000 to Sprint PCS (HSD presentation)			
<b>Keywords for Searching:</b>		<b>Products that will use this invention:</b>	
CDMA, High Speed Data, Wireless Internet/IP, Higher Spectral Efficiency Modulation		IS-95/IS-2000 CDMA Networks, 3GGP/UMTS CDMA Networks	
<b>Does this invention arise from any arrangement involving an external organization?</b> no			
<b>Is this invention relevant to a Standards Activity?</b>		<b>Internal Funding Project #'s:</b>	
yes		7417	
<b>If so, give details:</b>			
IS-2000 Release-B in the 3GPP2 Forum 3GPP TSG-RAN WG#1			



## Technical Information

### **Brief Description of the Invention:**

An Asyemmtical Wireless high speed data system architecure is proposed. The Forward Link is designed as Time Divison Multiple Access Mode and the Reverse Link is designed as Code Division Multiple Access Mode. Shorter frame/slot structure is introduced in order to allow the fast coding/modulation and link adaptation on the Forward Link, higher order modulation is used to increase the Forward Link peak data rate.

### **Problem Solved by the Invention:**

The current 3G wireless service has a limited ability to provide Internet service due the limitation on the data rate. It can not meet the need of fast increase of demand for the higher speed wireless IP service, especially the Internet downloading.

### **Solutions that have been tried and why they didn't work:**

The IS-2000 release-A designed for the 3G wireless service can not deliver higher enoguh throughput for the Internet access and download. The IS-2000 provide only a limited range of data rate service. The HSD is design to enhance the IS-2000 capability for the Wireless Internet applications.

### **Specific elements or steps that solved the problem and how they do it:**

The following are new solutions to enable the high speed data Internet downloading possible:

- [1] Short frame and slot structure, to allow
  - (1) fast C/I reporting
  - (2) fast adaptive coding and modulation
  - (3) fast base station slection and re-selection
- [2] TDM Blank-and-Burst multiple access scheme to allow
  - (1) maximum the data rate for user with best C/I condition
  - (2) maximum the high speed rate service range
- [3] Puncture bursty pilot and explicit data rate information encoding to allow
  - (1) fast and accurate channel estimation
  - (2) header decoding to detect the explicit data rate, save terminal power
  - (3) maximize the data payload
- [4] Slot/bandwidth reservation to allow
  - (1) simultaneous voice and data service
  - (2) Ensure certain calss user QoS

### **Commercial value of the invention to Nortel and Nortel's major competitors:**

A significant market value for the future Nortel wireless and IP business.

Exhibit 0

## NORTEL NETWORKS LIMITED

### POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS that Nortel Networks Limited (the "Corporation"), a corporation duly organized and existing under the laws of Canada, and having its executive offices at 8200 Dixie Road, Suite 100, Brampton, Ontario, L6T 5P6, Canada, hereby constitutes and appoints Angela deWilton – IP Strategy, Curtis Dodd – IP Counsel, Jean-Pierre Fortin – IP Lead, Jaspreet Harit – IP Counsel and William Junkin – Patent Portfolio Management, as its attorneys, acting individually, with full power and authority to do all acts and things as fully and effectually as and in the name, place and stead of the Corporation, with respect to the prosecution of patent, trademark and copyright applications, the execution of any and all documents respecting the assignment of copyrights held by the Corporation and the release of employees of the Corporation from intellectual property assignment clauses in their employee agreements.

The Corporation hereby ratifies and confirms and agrees to ratify and confirm whatever its said attorneys shall do or purport to do in and by virtue hereof whether prior to or after the date hereof.

The Power of Attorney issued March 11, 2002, is hereby rescinded without impact or effect on any actions taken thereunder.

IN WITNESS WHEREOF, the Corporation has caused this Power of Attorney to be executed and signed this 14<sup>th</sup> day of January, 2005, and its corporate seal to be hereunto affixed.

NORTEL NETWORKS LIMITED



Nicholas J. DeRoma  
Chief Legal Officer



Gordon A. Davies  
Assistant General Counsel – Securities and  
Corporate Secretary

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